

## Section 602. CONCRETE PAVEMENT CONSTRUCTION

**602.01 Description.** This work shall consist of constructing a jointed Portland cement concrete pavement, unbonded overlay, base course, or shoulder, with or without reinforcement. The Contractor shall have a concrete quality control plan in place as required by section 604 before concrete production begins.

A. **Classification.** Types of concrete pavement will be shown on the plans. Where the term "pavement" is used in a general sense, it may include any of the following types or classifications.

1. **Concrete Pavement.** Sections of standard widths and of lengths conducive to production paving. Typically includes mainline pavement, multiple lane ramps and collector-distributor roadways.
2. **Concrete Overlay.** Sections of standard widths and lengths conducive to production paving. Concrete pavement placed on an existing pavement section.
3. **Miscellaneous Concrete Pavement and Miscellaneous Concrete Overlay.** Sections of variable widths and limited lengths not conducive to production paving. Typically includes single lane ramps, acceleration/deceleration lanes, approaches and intersections.
4. **Temporary Concrete Pavement.** Concrete pavement constructed for temporary duration.
5. **Concrete Pavement with Integral Curb.** Pavement and curb constructed integrally.
6. **Concrete Base Course.** A concrete pavement that will be surfaced with a hot mix asphalt or concrete pavement overlay.
7. **Concrete Shoulders.** Concrete pavement placed as shoulders.

**602.02 Materials.** Materials shall meet the following requirements.

Concrete, Grades HE, P1, P2 .....	601
Curing Materials .....	903
Epoxy Coated Lane Ties .....	905
Steel Reinforcement .....	905
Bond Breaker Material .....	914
Joint Materials .....	914

The concrete for concrete pavement and miscellaneous concrete pavement shall be Grade P1 as designated on the project plans. Grade P2 or Grade P1 shall be used for concrete base course, concrete shoulders, and temporary concrete pavement as designated on the project plans. Grade HE shall be used where high-early strength gain is required. When concrete shoulders are cast integrally with concrete pavement, the grade designated for the concrete pavement shall be used.

A transparent compound shall be used for curing base course concrete; white or transparent compound shall be used for temporary concrete pavement; and white compound shall be used for all other pavement, shoulders, and curb surfaces. On concrete overlays, a wax based, white curing compound shall be applied over the hot mix asphalt bond breaker course at an application rate of one gallon per 22 square yards.

Epoxy coated lane ties or deformed bars will be installed as specified by Standard Plan R-41 Series. For epoxy coated load transfer dowels delivered without the bond-breaking coating, the Contractor shall submit to the Engineer written certification naming the specification designation of the asphalt or equivalent material that will be used for the coating and certifying that the material conforms to specification.

### 602.03 Construction.

- A. **Equipment.** The Contractor shall furnish and maintain all equipment necessary to complete the work.

1. **Fixed Forms and Back-Up Rails.** When paving with fixed forms, back-up rails shall be used which can be attached to the forms to raise equipment wheel flanges clear of previously cast pavement.

Forms shall be metal with sufficient section rigidity to support the paving equipment used on the project.

Flexible or standard steel forms with flexible liners shall be used when the radius is less than 150 feet, except when temporary concrete pavement is specified.

2. **Form Tamper.** Form tampers shall be capable of thoroughly and uniformly compacting the base under fixed forms. For construction of concrete pavement, mechanical form tampers will be required except that hand tampers will be permitted for adjusting short sections.

For construction of concrete base course, miscellaneous concrete pavement, and temporary concrete pavement, hand tampers may be substituted for mechanical tampers.

3. **Concrete Spreader.** An approved device is required to spread and strike off each layer of concrete and for finishing the top layer of concrete. It shall have sufficient weight and rigidity to properly strike off the concrete.
4. **Dowel Bar Inserter (DBI).** An approved mechanical DBI that automatically installs load transfer bars, at the required depth, and properly consolidates the surrounding concrete may be used in lieu of load transfer assemblies.
5. **Lane-Tie Installer.** A mechanical installation device shall be used unless the lane ties are placed on chairs. Manual installation methods are permitted for temporary concrete pavement.

6. **Reinforcement Bridge.** Reinforcement not placed on chairs, or mechanically picked up off the grade, shall be transferred from the hauling equipment to a movable bridge which spans the pavement being cast. The bridge shall be capable of carrying the reinforcement load without deflecting the form or rutting the track line.
7. **Internal Vibrator.** Sufficient internal vibrators for consolidating the concrete shall be provided. They shall be approved mechanical vibrators of an internal type, capable of visibly affecting the concrete for a distance of approximately one foot from the vibrator head. The vibrators shall be connected with the equipment on which they are mounted such that vibration of the concrete will start automatically with the forward movement of the equipment and stop automatically when the forward movement stops.
8. **Floating and Finishing Equipment.** The floating and finishing equipment shall be capable of shaping, screeding, and floating the concrete in a manner such that a dense, homogeneous pavement will be produced, shaped to the specified cross section and grade, requiring only a minimum of hand finishing.

Hand floats and straightedges shall be at least 10 feet in length and shall be rigid and free from warps. The handles shall be of sufficient length to permit finishing half the width of the pavement being placed. Hand floats shall be of the box or channel type. The floating face shall be at least 6 inches in width.

If the Contractor elects to use manual or semi-automated finishing equipment, the maximum width of concrete placement shall be limited to one lane, unless the Contractor demonstrates to the satisfaction of the Engineer that the methods and equipment meet the requirements of subsection 602.03.A.3 and 6.

9. **Straightedges for Testing Surface Smoothness.** The Contractor shall furnish two 5-foot straightedges and one 10-foot straightedge, rigid and free from warps, for the Engineer's use.
10. **Stencils.** The Contractor shall furnish a template device for imprinting the pavement. The numerals shall be 3 to 4 inches in height and at least ¼ inch in depth.
11. **Foot Bridges.** At least one moveable bridge shall be provided for use in finishing the pavement, installing monument boxes, doing wet checks, and crossing the pavement. Foot bridges spanning slab widths of 16 feet or more shall be equipped with wheels or shall be an integral part of the paving equipment. The bridges shall be of such design and construction that they will not come in contact with the concrete.
12. **Membrane Sprayer.** Mechanical equipment shall be used to apply curing compound to all mainline and full lane width pavements. The mechanical equipment shall be self contained, self supported and ride on wheels or tracks located outside of the paving lane. The sprayer shall be capable of applying a continuous uniform film at the specified rate and shall be of the fully atomizing type. The equipment shall provide continuous stirring or agitation of the curing compound during applications.

Hand spraying equipment may be used on small and irregular shaped pours as approved by the Engineer. The sprayer must be capable of applying a uniform film, of atomized curing compound, at the specified rate.

Inspection of the curing equipment shall include a demonstration of the capability to properly apply curing compound prior to daily production.

### 13. **Joint Sealing Equipment.**

- a. **Preformed Neoprene Joint Seal.** Equipment for applying the lubricant and installing the preformed joint seal may be either power or hand operated equipment as recommended by the joint seal manufacturer.
- b. **Splicing Preformed Neoprene Joint Seal.** The Contractor shall obtain a copy of the splicing system details from the supplier prior to sealing joints. The splicing system details shall be submitted to the Engineer prior to splicing.
- c. **Hot-Poured Rubber-Asphalt Type Compound.** The heating kettle for hot-poured rubber-asphalt type sealing compound shall be of the indirect heating or double-boiler type, using oil as the heat transfer medium. It shall have a thermostatically controlled heat source, a built-in automatic agitator, and thermometers installed to indicate both the temperature of the melted sealing material and that of the oil bath. The Contractor may be required to demonstrate that the equipment proposed for use will consistently produce a joint sealant of proper pouring consistency.

When the hot-poured sealing material is applied, the kettle shall be equipped with a pressure pump, hose and nozzle suitable for forcing the sealing material to the bottom of the joint and completely filling the joint. Heat from a direct flame on the nozzle shall not be used to maintain the temperature of the sealing material.

- d. **Cold-Applied Joint Sealing Compound.** Cold-applied joint sealing compound shall be applied by means of pressure equipment that will force the sealing material to the bottom of the joint and completely fill the joint without spilling or overfilling the material on the surface of the pavement.

- B. **Preparation of Base.** The base shall be smoothed, trimmed and compacted substantially to the required line, grade and cross section to receive the pavement, as described under subsections 302.03.A and B, and shall be maintained in that condition as described under subsection 302.03.C. The base shall be prepared sufficiently in advance, as determined by the Engineer, of the form setting or slip-form paving operation to allow for testing and acceptance of the base.

Concrete placement shall not take place if any portion of the base, subbase, or subgrade layers are frozen, or if the grade exhibits poor stability from excessive moisture levels. The base shall be moist at the time of placing concrete, but shall not be muddy, soft, or frozen.

When a slip-form paver is used, with automatic elevation control referenced to the top of the base, the areas along which the paving equipment will travel shall be cut to the

accuracy required for side forms under Subsection 602.03.C. When a slip-form paver with automatic elevation control is used, the base along the trackline shall be cut to the accuracy specified in Subsection 302.03. If any construction equipment is permitted to use the prepared grade, the base shall be checked and corrected before placing the concrete.

- C. **Placing Forms.** The compacted base shall be trimmed reasonably close to the staked grade by the use of base preparation equipment. The base on which the forms are to be placed shall be checked for line and grade and all irregularities shall be corrected before placing the forms. The base shall be thoroughly compacted for a sufficient distance outside the area to be paved to adequately support the forms.

Forms shall be set sufficiently in advance of placing concrete to provide time for the Engineer to check them. The forms shall have uniform bearing directly on the base throughout their entire length and width. All forms shall be joined neatly, locked securely, and firmly staked by at least three stakes per form segment.

During paving, vertical and horizontal movement of the forms shall not exceed  $\frac{1}{8}$  inch and  $\frac{1}{4}$  inch, respectively. Flexible forms shall be braced to prevent movement during concrete placement.

After the forms are set in place and cleaned of any hardened concrete or mortar, they will be checked by the Engineer. When requested by the Engineer, the Contractor shall erect stringlines for checking line and grade. Form lines showing a variance from the staked line by more than  $\frac{1}{2}$  inch or from the staked grade by more than  $\frac{1}{8}$  inch shall be adjusted.

Forms shall be coated with a debonding compound before installation of lane ties and/or placement of reinforcement. Do not use oil as a debonding compound.

- D. **Placing Concrete.** All structure castings shall be set to grade and alignment prior to, or during, placement of concrete, except that the boxing-out method will be permitted for constructing concrete base course and temporary concrete pavement. All structure castings shall be cleaned thoroughly to permit adhesion of the concrete.

The top of the forms shall be kept free from concrete and all other substances during the placing and finishing operations.

The vertical surfaces of previously placed concrete and the adjacent grade shall be inspected and cleaned of any materials that would prevent an adjoining concrete pour to properly consolidate or conform to the physical plan dimensions. Before an adjoining pour, the open-graded base shall be inspected for contamination by material fines or debris that has occurred. The Engineer will determine whether the contamination is sufficient to require removal and replacement. Removal and replacement shall be at the Contractor's expense.

When pavement is constructed on a base that could sustain damage from the hauling units, a mechanical means shall be provided to transfer the concrete from the hauling units to the grade. The mechanical equipment shall be self contained, self supported and ride on wheels or tracks located outside of the paving lane. The concrete shall be spread and

struck off as soon as it is deposited on the base. The method and manner of placing shall be such as to avoid segregation. The concrete along the faces of fixed or sliding forms and adjacent to transverse dowel bar assemblies shall be consolidated by means of an internal vibrator to fill all voids and ensure a dense smooth surface. If sufficient vibration of the concrete is attained by use of a reinforcement installer, the use of vibrators along the faces of forms may be omitted.

When slipform methods are used, the equipment shall vibrate concrete for the full width and depth of the pavement being placed. When the concrete is placed in two layers, the consolidation may be accomplished after the top layer has been placed.

All vibratory and tamping action shall cease when paving equipment stops.

Sufficient labor, materials, and equipment shall be provided to ensure continuity of the paving operation. In the event that any piece of equipment does not have sufficient capacity to keep pace with the other operations, the Engineer may limit the rate of production to prevent poor workmanship, overloading of equipment, or frequent delays. The top layer of concrete shall be placed within 30 minutes after the bottom layer is placed. In the event of an unavoidable interruption of the work for longer than 30 minutes, a transverse end of pour joint Symbol H, shall be placed.

Equipment shall be operated in a manner to prevent damage to pavements and bridge decks and to maintain proper grade in transitioning from the pavement to the deck.

No vehicles or equipment, other than joint saws or ride quality measurement equipment, will be permitted on any new pavement, or portions thereof, until the concrete has attained the strength required under subsection 104.11.

Existing pavements shall be kept clean of materials that may interfere with finishing operations or cause damage to the surface.

When slipformed pavement is placed in two layers, the first layer may be cast 3 to 6 inches narrower (but at least twice the largest size aggregate dimension) on each side than the proposed pavement slab, so that the full depth of pavement will be cast at the edges with the second layer.

All concrete placed each day shall be finished during daylight unless there is sufficient artificial lighting furnished by the Contractor.

1. **Temporary Pavement Crossing.** Where gapping of concrete pavement is specified for the maintenance of traffic, the Contractor shall either leave the specified gaps or shall place a temporary bridge or pavement crossing, of a design approved by the Engineer, according to section 812.
- E. **Placing Pavement Reinforcement.** The reinforcement shall be placed from a reinforcement bridge, or by other approved means that will avoid contamination of the concrete. The reinforcement shall be free of loose rust and other contaminants at the time of placing.

## F. Constructing Joints.

1. **Longitudinal Lane Tie Joints with Straight Tie Bars (Symbol D).** Tie bars shall be placed at the required depth parallel to the finished surface, at right angles to the joint and at the uniform spacing called for on the plans. The installation of lane tie bars, except for temporary concrete pavement, shall be by the use of approved chairs or by the use of an approved mechanical device. Placing lane tie bars in the concrete by hand methods will not be permitted.

The installation of lane tie bars and the sawing of joints will not be required for temporary concrete pavement unless specified in the contract documents.

2. **Longitudinal Bulkhead Joints (Symbol B).** Epoxy coated bent bars shall be installed parallel to the surface of the pavement and approximately at right angles to the edge of pavement. The bent bars shall be installed in a manner to allow consolidation around the bar without causing edge slump. After the concrete has gained sufficient strength, bent tie bars shall be straightened. Straightened tie bars shall be approximately parallel to the surface of the pavement and approximately perpendicular to the edge of the pavement.

Epoxy coated bent tie bars shall be installed and straightened in a manner and using equipment such that the epoxy coating is not torn or loosened within 6 inches of the joint face. Any tears or loosening of the epoxy within 6 inches of the joint face shall be repaired using the coating material recommended by the coating manufacturer.

Lane ties spacing and installation methods shall ensure that the lane ties will meet the pull out resistance requirements of Table 602-1.

For projects having less than 1000 feet of longitudinal bulkhead joints verification tests may be waived by the Engineer.

If the test results on the ties from the first day of placement meet the requirements of Table 602-1, additional testing will be at the discretion of the Engineer and will be based on comparison of the installation methods and spacings of the first day with subsequent pours.

If the average pull-out resistance is less than the minimum requirements, the Contractor shall install additional epoxy-anchored lane ties according to Standard Plan R-41 Series to meet the specified requirements. No additional payment will be made for this work.

Placement of adjacent pavement shall not be made until the Engineer has tested the lane ties.

**Table 602-1 Lane Tie Pull-Out Resistance**

Distance From Joint Being Constructed to Nearest Free Edge of Completed Pavement (a)	Average Pull-out Resistance in ft-lbs of Joint, Minimum (b) (c)
12 feet or less	2200
Over 12 feet to 16 feet	3200
Over 16 feet to 23 feet	4500
Over 23 feet to 27 feet	5200
Over 27 feet to 35 feet	6800
Over 35 feet(d)	
a. Includes combinations of tied lane widths, valley gutter, curb & gutter, or concrete shoulder. b. Slippage shall not exceed $\frac{1}{16}$ inch. c. Refer to Section D7 of the Materials Quality Assurance Manual for Inspection Procedure d. As directed by the Engineer	

3. **Transverse Joints.** All transverse contraction and expansion joints shall be sawed as specified under subsection 602.03.N. Pavements without load transfer bars shall have transverse plane-of-weakness joints constructed according to the details shown on the plans.

When the pavement is placed in partial width slabs, transverse joints in the adjacent slab shall be placed in line with like joints in the first slab. When it is anticipated that adjacent slabs will be placed after September 15, adjacent slabs placed before September 15 shall contain expansion joints as shown on the standard plans to conform with pavement placed after September 15. When widening existing pavements, transverse joints shall be placed in line with like joints in the existing pavement and, when directed by the Engineer, in line with "working" cracks functioning as joints.

- a. The transverse joint assemblies containing the load transfer bars shall be set sufficiently in advance of placing concrete to provide time for the Engineer to check them for condition, line, and grade. The assemblies shall be placed according to the standard plan. The shipping wires shall be removed after the load transfer assemblies are staked in place and prior to concrete placement. Removal shall consist of cutting both ends of the shipping tie wire adjacent to the connection to longitudinal support wire.

For expansion joints, the free end of the bar shall be fitted with a close-fitting cap of an approved design.

Where more than one section of premolded joint filler is used in a joint, the sections shall be tightly butted together. The bottom edge of the premolded filler shall be in contact with the base and the top edge shall be at the depth below the surface of the pavement shown on the standard plans. The expansion joint filler shall be maintained perpendicular to the surface of the pavement and at right angles to the centerline of the pavement.



- b. End-of-pour joints (Symbol H) shall be constructed as shown on standard plan when it is anticipated that 7 days or more will elapse between the casting of adjacent pours. When operations are to resume before 7 days, the joint shall be constructed at a contraction or expansion joint and shall be formed by placing a bulkhead in the center of the load transfer device.
- c. When a dowel bar inserter (DBI) is used to install load transfer bars, the bars shall be placed at the same spacing as detailed for dowel bar assemblies in Standard Plan R-40 Series. The pavement shall be placed and consolidated full-depth prior to insertion of the dowel bars.

The DBI shall accurately insert dowel bars at the joint spacing and location shown on the plans. The DBI shall insert dowel bars into the full-depth plastic concrete at the specified location, and shall consolidate the concrete around the dowel bars such that no voids exist, without the supplemental use of hand-held vibrators. Dowel bars shall be inserted within a tolerance of  $\frac{1}{4}$  inch in the length of the bar in both the vertical and horizontal planes of the pavement. The dowels shall be placed symmetrically over the transverse joint within a tolerance of 2 inches.

The Contractor will measure the inserted dowels to verify that the tolerances are met. These measurements will be witnessed by the Engineer. Documentation shall be provided to the Engineer when requested. It is anticipated that no more than one percent of the transverse joints will be wet checked in a day. Any out of tolerance joints shall be marked and replaced at the Contractor's expense.

The Contractor shall locate the night header at a planned or relocated (as approved by the Engineer) transverse joint. The Contractor shall also place a test joint beyond the night header. This joint shall be sawed full depth and removed for inspection of the dowel bar placement prior to the next day startup. Dowels may be installed in the night header by either excavating into the plastic concrete, or after full depth sawing of the previous day's pour in drilled or preformed holes. If the Contractor's paving operation does not stop at night, the Engineer will determine the test joint location. The Engineer may waive the test joint requirements if three successive days of satisfactory performance is documented after the start of production paving.

- G. **Screeding.** Concrete pavement shall be screeded and consolidated to conform to the final cross section. Machine methods shall be used which will avoid material segregation.

Manual methods may be used for concrete pavement gaps less than 160 feet in length and a maximum of one lane width, or when the pavement is entirely concrete base course.

Water to enhance finishing operations is not permitted, unless directed by the Engineer. When permitted, the water shall only be applied as a fog spray or fine mist to replace surface evaporation.

- H. **Finishing Surface.** After screeding or extruding, the finished surface shall present a smooth, sealed, uniform appearance conforming to the final cross section.

- I. **Straightedge Testing, Surface Correction, and Edging.** While the concrete is still plastic, the Contractor shall test the slab surface for trueness using a 10-foot straightedge or other method approved by the Engineer. The finished surface shall meet the required specification and cross section.

If depressions or high spots exceeding  $\frac{1}{8}$  inch in 10 feet ( $\frac{1}{4}$  inch for concrete shoulders and  $\frac{3}{8}$  inch for concrete base course and temporary concrete pavement) are found, paving operations shall be suspended and corrections made to the finishing procedures. Paving operations may be resumed when approved by the Engineer.

High spots in pavements in excess of these tolerances shall be corrected.

High or low spots in excess of  $\frac{1}{2}$  inch in 10 feet or in excess of  $\frac{3}{4}$  inch in 50 feet will be evaluated by the Engineer according to subsection 104.04.

Any edge settlement in excess of  $\frac{3}{8}$  inch shall be corrected before the concrete has hardened. When edge settlements in excess of  $\frac{1}{4}$  inch persist, paving shall be suspended and corrections made before the resumption of paving will be permitted.

Pavement edges, other than temporary concrete pavement edges, shall be left without overhanging projections.

The final elevation of each drainage structure casting shall also meet the requirements of this subsection. Any structure not meeting the requirements of this section will be evaluated by the Engineer according to subsection 104.04.

- J. **Ride Quality.** Specifications for ride quality are detailed in the contract documents.
- K. **Texturing.** As soon as the pavement has set sufficiently to maintain a texture, the concrete surface shall be dragged longitudinally with one or two layers of an approved damp fabric material to produce the texture. This fabric shall be in contact with the surface across the entire width of concrete being placed.

Immediately after dragging, all surfaces other than concrete base courses and shoulders shall be grooved. The grooves shall be oriented generally perpendicular to the centerline and shall be formed in the plastic concrete while the concrete is in such condition that the grooves will be formed cleanly without either slumping of the edges or severe tearing of the surface. The desired surface texture consists of grooves spaced  $\frac{1}{2}$  inch on center,  $\frac{1}{8}$  inch wide, and  $\frac{1}{8}$  inch to  $\frac{1}{4}$  inch deep. Some randomness in spacing is desirable.

Pavement surfaces not grooved as specified shall be corrected at the Contractor's expense. The Contractor shall submit a plan for removal and replacement for the Engineer's approval. The plan must include collection and disposal of residue from retexturing.

If the Engineer determines that texturing operations are delaying curing, then the curing operation shall take precedence over texturing. No texturing of the plastic concrete shall be allowed after the curing compound is applied. If texturing has not been completed prior to the placement of curing compound, the Contractor shall complete the surface texturing

after the pavement has achieved the open to traffic strength. The Contractor shall submit a plan for the Engineer's approval for texturing the pavement. This work shall be at the Contractor's expense.

- L. **Stenciling Pavement.** After texturing, the Contractor shall stencil survey station numbers into the surface. Stationing shall be located about 12 inches from the edge of the pavement so that they can be read in the direction of traffic by a person driving on the outside shoulder. On two-way roadways, the station numbers shall read in the direction of stationing.

The month, day, and year shall be stenciled at the beginning and end of each day's pour near the edge of the slab opposite that used for stationing and shall be placed so that it can be read in the direction of the pour.

Concrete base courses and temporary pavements need not be stenciled.

Underdrain outlets shall be marked in concrete shoulders, according to section 404. The Contractor shall stencil the marker into the concrete surface, after texturing.

- M. **Curing.** After texturing operations have been completed and after the free water has left the surface, the pavement surface and sides of slip-formed pavement, shall be completely coated and sealed with a uniform layer of membrane curing compound.

One application is required for non-grooved surfaces and two applications are required for grooved surfaces. The application rate for curing compound shall not be less than one gallon per 25 square yards of surface for each application. The second application cannot be applied until the first application has dried (never to exceed two hours) to avoid material pooling and filling of the grooves.

Curing shall not be delayed to accomplish texturing. If texturing operations are delaying curing, then the curing operation shall take precedence over texturing.

The compound shall be kept thoroughly mixed according to the manufactures recommendation. Curing compound shall not be thinned.

For miscellaneous concrete pavement over one lane in width, where a manually operated pressure-type sprayer is used, the compound shall be applied from a foot bridge.

If the layer of curing compound is damaged by rain or other means, such as sawing of joints or foot traffic to carry on the work, before the pavement obtains 70 percent of its design strength, an additional application shall be applied to all affected areas immediately.

If fixed-forms are removed during the curing period, the entire area of the sides of the pavement shall be coated with curing compound immediately after removal of the forms.

When approved by the Engineer, curing compound may be omitted when cold-weather protection is used during the curing period.

The above requirements for curing are minimum requirements only. Any concrete showing injury or damage due to inadequate curing shall be repaired or replaced at the Contractor's expense.

N. **Sawing Joints.** Joints shall be sawed according to the details shown on the plans. The concrete saw will be permitted on the pavement as necessary to saw the joints but a water supply truck will not be permitted on the pavement until the pavement has attained the required strength, as specified in subsection 104.11.

1. **Longitudinal Joints.** Symbol D longitudinal joints, as shown on the plans, shall be sawed as soon as the concrete has hardened enough so that no excess raveling or spalling occurs but before any random cracks develop.
2. **Transverse Contraction and Expansion Joints.** The joint groove in expansion joints shall be constructed according to the specified standard plan. All loose concrete and slurry shall be completely removed, by flushing, from the groove and the immediate area.

If the specified seal is not installed within 7 days of final sawing, the joint groove shall be temporarily sealed with a suitable material or device to prevent the infiltration of foreign material.

Vehicles shall not be permitted over the full width joint grooves prior to the installation of either the permanent seal or a temporary seal. The joints shall be constructed by sawing in two stages, except that joints in concrete produced with slag coarse aggregates and sawed with a dry abrasive blade may be sawed in one operation.

For joints constructed in one operation, the joint groove shall be sawed before any transverse cracks develop. Ravelling or spalling along the joint shall be repaired either by sawing a wider groove and installing a neoprene joint seal of proportionate size or by repairing the ravelled and spalled areas as specified in subsection 602.03.P.

For joints constructed in two stages, the sawing shall be accomplished in two stages.

**First Stage.** The first stage shall be a relief cut directly over the center of the load transfer assembly or over the preformed joint filler. The sequence of initial sawing shall be at the Contractor's option. The relief cut shall be made as soon as the concrete has hardened enough so that no excess ravelling or spalling occurs but before any random cracks develop. For closely spaced joints in non-reinforced pavements, relief cutting of alternately spaced joints will be permitted provided that all sawing is completed before random cracking develops. No traffic shall be permitted over the expansion joint relief cuts.

**Second Stage.** Second stage sawing shall not begin until the concrete has attained at least 1000 psi compressive strength. If necessary, the curing process of the concrete in the vicinity of the joint shall be maintained by installing the permanent joint sealant or by placing some temporary cover material. Second stage sawing of expansion joints

shall receive priority over contraction joints when higher pavement temperatures are pending.

The joint groove shall be centered over the relief cut and sawed to the specified plan dimensions. The groove width shall be adjusted to compensate for any change in the relief cut due to pavement contraction.

- O. **Coring of Pavement.** The Contractor will be permitted to core the pavement, for information, the day following casting. Coring shall be accomplished with portable lightweight equipment of a type and gross weight as to not damage the pavement. Pickup trucks, or similar transporting equipment will not be allowed on the uncured pavement. Maximum core diameter permitted will be 4 inches.

A maximum of six cores per mile (maximum of one per slab), may be taken to monitor pavement thickness and steel location. Core holes shall be filled with fresh concrete, consolidated and finished during the day cores are taken. Immediately following core hole filling and finishing, the method of curing in use on the pavement shall be re-established for all areas disturbed during the coring operation.

These cores shall be for the Contractor's information only. They will not be tested by the Department. Regular coring for thickness and steel location determinations will be performed by the Department according to section 602.04.

- P. **Patching Transverse Joints.** After the joints have been sawed and cleaned as specified, all joints in pavements shall be inspected for spalls and voids. Joints in concrete base course and temporary concrete pavement need not be repaired unless they contain spalls classified as intermediate or major in size.

All loose, unsound, or damaged concrete shall be removed to the satisfaction of the Engineer.

Spalls and voids will be classified as minor, intermediate, or major spalls and shall be repaired accordingly.

1. **Minor Spalls.** Any spalls or voids that are less than 36 square inches (length times width beyond joint face) but which exceed the following limits shall be repaired by patching with an approved epoxy mortar before the seal is installed.
  - a. Spalls which extend more than  $\frac{1}{4}$  inch from the joint face and over  $\frac{1}{2}$  inch below the surface of the pavement.
  - b. Spalls which extend more than  $\frac{1}{4}$  inch from the joint face and 2 inches or more in length, regardless of the depth of spall below the surface of the pavement.
  - c. Void areas larger than  $\frac{1}{2}$  inch in diameter in the upper one inch of the joint face or larger than 1 inch diameter regardless of location.

The spalled concrete surface shall be thoroughly cleaned by sandblasting or power wire brushing. Hand wire brushing may be permitted by the Engineer for limited patching. The patch area shall then be blown clean with a jet of oil-free compressed air. A rigid polyethylene sheet, or other rigid material covered with polyethylene film, shall be inserted into the joint groove and held tightly against the joint face that is to be patched.

The concrete shall be clean and dry at the time the epoxy mortar is placed. When the surface of the concrete is 32 °F or lower, the surface shall be made free of frost by heating with a clean source of heat which will not leave a deposit of carbon on the concrete. Heat shall be gradual and evenly applied so that the concrete is not damaged.

Type I epoxy binder shall be used for temperatures from 60 to 104 °F and Type II for temperatures from 36 to 60 °F per subsection 914.05.

The epoxy binder will be a mixture of two parts epoxy resin to one part curing agent, by volume; or as recommended by the epoxy manufacturer. Unless the entire contents of the original containers are used in one batch, a mechanical volumetric dispensing device which dispenses each component within an accuracy of  $\pm 2$  percent by volume shall be used for proportioning. The dispenser shall meet the approval of the Engineer.

A clean metal or polyethylene vessel shall be used for mixing. The curing agent component shall be gradually added to the epoxy resin component with constant stirring. A low speed air or electrically driven stirrer shall be used for this purpose. The stirring shall be continued for 2 to 3 minutes until a uniform mixture is obtained.

After the epoxy binder is thoroughly mixed, a small portion shall be reserved for priming. The dry masonry sand shall be uniformly blended into the balance of the mixture to give an epoxy mortar of stiff but trowellable consistency (approximately 3.5 parts of dry sand, by volume, to one part of mixed binder).

The spalled surface shall be primed with the freshly mixed epoxy binder. This prime coat shall be scrubbed into the surface with a suitable brush to insure complete wetting and coverage of all areas to which the epoxy mortar must bond. Immediately after priming, the epoxy mortar shall be placed in the spalled area and finished to the shape of the original pavement surface. If the bond coat is not tacky when the mortar is placed, due to hot weather or delays, a second application shall be made. The edge of the patch shall conform with the rest of the joint groove. Dry masonry sand shall be sprinkled onto the fresh epoxy mortar surface to eliminate any gloss. After the epoxy mortar has cured sufficiently so that it will not be damaged during sealing operations, the polyethylene insert shall be carefully removed.

2. **Intermediate Spalls.** Any spalls larger than 36 square inches are classified as intermediate sized spalls; except when the pavement is reinforced and the spall depth extends below the reinforcement, or when non-reinforced and the spall depth exceeds 4 inches. Intermediate spalls shall be repaired by sawing and chiseling out the unsound concrete and patching with Portland cement mortar as specified below. (If there are only a limited number of intermediate spalls to be patched, the epoxy primer and mortar

system under Minor Spalls may be used if approved by the Engineer, but the parallel saw cut and chipping and mixing devices specified below will be required.)

A saw cut shall be made parallel to the joint groove at the outer extremity of the spalled area. This cut shall be at least one inch deep. The concrete shall then be chipped out to the saw cut so that a vertical face is present at the back of the repair area. The two ends of the repair area shall be cut to approximately vertical faces. The entire area to be repaired shall be sandblasted to remove all loose particles and then blown clean with a jet of oil-free compressed air to remove the sand and all other foreign materials. The entire area shall then be flushed with clean water. Excess water shall be blown out with oil-free compressed air so that no pools of water are present in the repair area. A rigid polyethylene sheet, or other rigid material covered with polyethylene film, shall be inserted into the joint groove and held tightly against the joint face that is to be patched.

The bottom and vertical faces of the repair area shall be primed with Type R-1 grout of creamy consistency. This prime coat shall be scrubbed into the surface with a suitable brush to ensure complete wetting and coverage of all areas to which the Portland cement mortar must bond. This cement grout must be carefully applied to eliminate pooling in the rough surfaces of the spall area. It should be applied immediately prior to placing the fresh mortar so that the prime coat is still wet when covered by mortar.

The Portland cement patching material shall be tamped into the primed repair area and finished flush to the pavement surface. A Type R-2 mortar of stiff consistency shall be used. A liquid air-entraining admixture shall be added to maintain an air content of 8 to 11 percent. Calcium chloride in an amount of not to exceed 2 percent of the cement content may be permitted, or required, to be added as an accelerator. The edge of the patch at the joint face shall conform with the rest of the joint groove. White membrane curing compound shall be sprayed on the patch surface immediately after the mortar is placed and finished. After 72 hours the polyethylene form shall be carefully removed.

3. **Major Spalls.** A major spall is one in which joint damage extends below the reinforcing mat or in which the damage extends more than 4 inches below the surface of the pavement for non-reinforced pavement. Major spalls shall be handled on an individual basis as directed by the Engineer.

- Q. **Repair of Longitudinal Joints and Edges.** Spalls of the sizes indicated under subsections 602.03.P.1.a and b, which occur between adjacent lanes of concrete shall be patched.

Where a concrete pavement will abut a hot mix asphalt surface, all spalls which extend more than  $\frac{3}{4}$  of an inch from the joint face and more than  $\frac{3}{4}$  of an inch below the surface of the pavement shall be patched. In addition, spalls less than  $\frac{3}{4}$  of an inch from the joint face and more than  $\frac{3}{4}$  of an inch below the surface of the pavement shall be patched when the cumulative total of spall lengths exceeds 20 feet per mile of pavement joint.

Spalls shall be patched as specified under subsection 602.03.P.1.

Any spall greater than 36 square inches in 10 feet will be handled on an individual basis as directed by the Engineer. The extent of repairs include up to pavement removal and replacement at the Contractor's expense.

- R. **Cleaning Joints.** All joints, including the surface of the pavement adjacent to the joint groove, shall be cleaned with appropriate tools and equipment to remove slurry, stones, or other foreign materials.

The faces of joints to be sealed with preformed neoprene need not be blast cleaned. The faces of all other joints (longitudinal and transverse) shall be blast cleaned with an oil-free dry abrasive just prior to sealing.

All joints shall receive a final cleaning with a jet of compressed air, free of oil and water, having a minimum pressure of 90 psi.

S. **Sealing Joints.**

1. **General.** Joints shall be sealed according to the plans and as specified herein.

Longitudinal joints shall be sealed before the transverse contraction joints are sealed.

Longitudinal joints and end-of-pour joints shall be sealed with one application of hot-poured sealant. Transverse contraction joints shall be sealed with preformed neoprene joint seals.

Transverse expansion joints shall be sealed with hot-poured sealant.

2. **Sealing Joints with Preformed Neoprene Joint Seal.**

The high-solids lubricant-adhesive specified shall be applied to the joint groove faces immediately preceding the installation of the preformed seal. If the method of installation so requires, the lubricant-adhesive may also be applied to the sides of the preformed seal. The preformed seal shall be installed by a suitable hand roller or machine, making sure that the lubricant-adhesive covers both sides of the seal over the full area of contact with the joint groove faces. Machines having lubricant pumps which are unable to pump the high-solids lubricant-adhesive may use a low-solids lubricant in amounts only as necessary to permit placement of the seal into the joint; the high-solids lubricant-adhesive is still required to be applied to the joint faces. Excess lubricant-adhesive shall not be present on the top of the seal after installation.

The seal shall be installed in a substantially compressed condition and shall be installed at the depth below the surface of the pavement as shown on the plans.

In placing the preformed seal in the joint groove, the maximum permitted longitudinal stretch shall be 5 percent and the maximum permitted longitudinal compression shall be 2 percent.



Where the longitudinal joint intersects the transverse contraction joint, a small gap shall be left in the longitudinal seal so that the transverse seal may be continuous across the longitudinal joint. Transverse joint seals shall be installed in one continuous piece as shown on the plans.

3. **Splicing Preformed Neoprene Joint Seal.** Splicing will be permitted only when required by project staging needs or as approved by the Engineer. The Contractor shall submit a written request, and shall demonstrate the splicing technique. The written request will contain justification, proposed splicing details, and the actual locations within the project limits where splicing is proposed. The Contractor shall demonstrate the splicing technique to the Engineer before field splicing. The maximum number of splices shall be limited to one per transverse joint, unless otherwise approved by the Engineer. The location of splices shall be 12 to 24 inches from a longitudinal joint, and will only be permitted between lanes constructed at different times. The completed splice shall have full adhesion along all contact surfaces, and shall be free from protrusion of excess adhesive on the exterior walls of the seal. The alignment of all edges at the splice shall not vary by more than  $\frac{1}{16}$  inch.
4. **Sealing Joints with Hot-Poured or Cold-Applied Sealants.** Hot-poured or cold-applied joint sealant shall be applied with pressure equipment with a nozzle extending into the groove so as to completely fill the groove with sealing compound.

The joints shall be sealed immediately after the joints are cleaned. The surface of the concrete shall be dry at the time of sealing. The sealant shall not be placed when the temperature is less than 50 °F.

The hot-poured joint sealant shall be melted in the heating kettle. Direct heating will not be permitted. Any sealing material heated in excess of the safe heating temperature recommended by the manufacturer shall not be used in the work.

Pouring shall be done by the use of a separate pouring pot of the double boiler type or from the melting kettle equipped with a pressure pump, hose, and nozzle. When approved by the Engineer, the hot-poured joint sealant may be poured with a hand-type pouring pot, provided a satisfactory joint is obtained. If the hand-type pouring pot does not produce a satisfactory joint, its use shall be discontinued and the mechanical pouring equipment shall be used. Joints shall be filled as shown on the plans.

Any sealant on the surface of the pavement shall be removed. Traffic shall not be permitted over the poured joint until the sealant has cured sufficiently to resist pickup.

#### **T. Weather and Temperature Limitations.**

1. **Protection Against Rain.** The Contractor shall take such precautions as are necessary to protect the concrete from being damaged by rain.
2. **Protection from Cold Weather.** The Contractor shall protect the concrete from freezing until the concrete has attained a compressive strength of at least 1000 psi.

Any concrete damaged by frost action shall be removed and replaced at the Contractor's expense.

3. **Cold Weather Limitations.** No concrete shall be placed unless the temperature of the air away from artificial heat is at least 25 °F and rising, unless specifically approved by the Engineer. Concrete placement shall not take place if any portion of the base, subbase, or subgrade layers are frozen, or if the grade exhibits poor stability from excessive moisture levels.
4. **Hot Weather Limitations.** The Contractor shall, as a part of the quality control plan, specify provisions to protect the pavement during hot weather conditions as defined in Table 706.1.
5. **Concrete Temperature Limitations.** Concrete shall not be placed when the temperature of the concrete at the point of placement is above 90 °F.

- U. **Freeway Shoulders.** When freeway shoulders are specified and described on the plans, the Contractor may elect to construct either a hot mix asphalt shoulder or a concrete shoulder.

#### 602.04 Measurement and Payment.

Contract Item (Pay Item)	Pay Unit
Conc Pavt, Reinf, ____ inch	Square Yard
Conc Pavt, Non-Reinf, ____ inch	Square Yard
Conc Pavt, Overlay, Furn and Placing	Cubic Yard
Conc Pavt, Overlay, Finishing and Curing	Square Yard
Conc Pavt with Integral Curb, Reinf, ____ inch	Square Yard
Conc Pavt with Integral Curb, Non-Reinf, ____ inch	Square Yard
Conc Pavt, Misc, Reinf, ____ inch	Square Yard
Conc Pavt, Misc, Non-Reinf, ____ inch	Square Yard
Conc Pavt, Overlay, Misc, Furn and Placing	Cubic Yard
Conc Pavt, Overlay, Misc, Finishing and Curing	Square Yard
Conc Pavt, Reinf, ____ inch, Temp	Square Yard
Conc Pavt, Non-Reinf, ____ inch, Temp	Square Yard
Conc Base Course, Reinf, ____ inch	Square Yard
Conc Base Course, Non-Reinf, ____ inch	Square Yard
Shoulder, Reinf Conc	Square Yard
Shoulder, Non-Reinf Conc	Square Yard
Shoulder, Freeway	Square Yard
Cement	Ton
Joint, Contraction, (type)	Foot
Joint, Expansion, (type)	Foot
Joint, Plane-of-Weakness, (type)	Foot
Conc, Grade ____	Cubic Yard
Pavt Gapping	Foot

- A. **Concrete Pavement and Base Course.** All concrete pavement and base course will be measured and paid for by area in square yards based on plan quantities. The pay items used will be based on whether or not reinforcement is required, the thickness specified, and the type of pavement specified (**Conc Pavt**; **Conc Pavt with Integral Curb**; **Conc Pavt, Misc**; **Conc Pavt, Temp** or **Conc Base Course**).

When **Conc Pavt with Integral Curb** is specified, it will be measured by area in square yards, including the area occupied by the curbs.

Transition areas between concrete valley gutter and concrete curb and gutter and also the concrete pavement cast integrally with concrete valley gutter at the apex of gore areas will be divided in half and each half measured in the units of the adjacent item.

Concrete headers abutting bridges and track crossings which are constructed by thickening the pavement, will not be measured separately but shall be included in the contract unit price bid for the pavement or base course.

B. **Concrete Shoulder.**

1. **Shoulder, Reinf Conc** and **Shoulder, Non-Reinf Conc** will be measured and paid for by area in square yards based on plan quantities.
2. **Shoulder, Freeway** will be measured and paid for by area in square yards based on plan quantities. When the Contractor chooses to use concrete for the shoulder, all the transverse joints in the shoulder and the external longitudinal pavement joint will be considered a part of the work of **Shoulder, Freeway** and will not be paid for separately.

C. **Concrete Overlay.**

1. **Conc Pavt, Overlay, Furn and Placing** used for concrete pavements and shoulders shall be measured and paid for by volume in cubic yards. The Engineer will determine the volume of concrete used each day, or fraction thereof, based on the number of batches used for pavement and shoulders, and the nominal volume of concrete per batch. This amount will be documented by the batch ticket printouts. This item shall include all materials, labor, and equipment necessary to furnish and place the concrete mixture.
2. **Conc Pavt, Overlay, Finishing and Curing** used for concrete pavements and shoulders shall be measured in place and paid for by area in square yards. This item shall include all materials, labor, and equipment necessary to finish and cure the concrete overlay and construct the longitudinal joints. Construction of transverse joints and removal of the existing pavement shall be paid for separately.
3. **Conc Pavt, Overlay, Misc, Furn and Placing** and **Conc Pavt, Misc, Non-Reinf, Finishing and Curing** shall be measured and paid for as described above, and shall be used for ramp reconstruction, ramp overlay, gore areas and approach areas.

- D. The additional cement required for Grade HE concrete over the amount required for the concrete specified for the standard strength concrete normally used, an additional 5.5 pounds per cubic foot for Grade P2 concrete and an additional 3.5 pounds per cubic foot for Grade P1 concrete, will be measured in tons of cement required for the number of square yards indicated on the plans, or directed by the Engineer, to be constructed with Grade HE concrete.

When the Contractor is approved to substitute a higher grade of concrete for a lesser grade (i.e., P1 for P2), the higher grade of concrete will be paid as per the original bid item at no increase in cost.

- E. **Pavement Gapping or Bridging.** Payment for **Pavt Gapping** includes all costs associated with the interruption of paving operations, moving back to later pave the gap, and the maintenance of cross traffic. Gapping of curbs, curb and gutter, gutters, driveways, and sidewalks is included in the unit price bid for the contract item being constructed and will not be paid for separately.

The concrete furnished and placed in the pavement gap, including all additional cement required by the plans, or as directed by the Engineer, to provide high-early-strength concrete will be measured and paid for at contract unit prices. The measurement for **Pavt Gapping** will be from end of concrete to end of concrete by length parallel to the centerline of the project for each individual lane of concrete pavement that is gapped.

- F. **Joints.** The transverse end-of-pour joint Symbol H and the transverse plane-of- weakness joint Symbol U will not be paid for separately. All other transverse joints will be paid for by length in feet, based on plan dimensions, for the type of joint required. The payment for the transverse contraction, expansion, and plane-of-weakness joints includes furnishing all joint materials required, such as load transfer assemblies, expansion joint fillers, and joint seals or sealants; sawing, forming, and cleaning the joints; furnishing and applying bond breaker where required; and furnishing and placing preformed neoprene seals or poured joint sealant as applicable. The sawing or forming and sealing of the vertical joint grooves at the edges of the pavement will not be measured nor paid for separately. Where preformed neoprene seal is called for on the plans for Detail D curb and gutter or valley gutter sections, the estimated length of contraction joint will be included in the contract quantities and the length of the joint will be based on the nominal width of the applicable curb and gutter or valley gutter section. Where expansion or contraction joints are called for on the plans for concrete shoulders, the estimated length of expansion and contraction joints required will be included in the contract quantities. The standard plan indicates whether the transverse joint is located in the pavement, shoulder, curb and gutter, valley gutter, or base course; whether or not the joint requires a load transfer assembly and/or expansion joint filler; and the type of sealant or seal required.

Internal and external longitudinal joints will not be paid for separately but shall be included in the cost of other contract items.

- G. Concrete accelerators shall only be used when called for on the plans or as approved by the Engineer. Concrete accelerator usage, approved for payment as extra work, shall be paid for at the invoice cost plus 15 percent.

H. **Determination of Pavement, Shoulder, and Base Course Thickness and Depth of Reinforcement.** Cores shall be taken from the pavement before its final acceptance to determine the thickness of the pavement and the depth of pavement reinforcement below the pavement surface according to MTM 201. Temporary concrete pavement, pavements within 4 feet of an obstruction, pavement areas of less than 300 square yards, or pavements less than 3 feet in width will be cored at the discretion of the Engineer.

1. **Price Adjustments.** The contract price for areas of concrete pavement deficient in thickness and/or having pavement reinforcement at an improper depth will be adjusted according to the following provisions.

Cores shall be classified according to Tables 602-2 and either 602-3A or 602-3B.

When an initial core from a pavement unit is classified other than Type AX, additional cores will be taken. Only the dimension that was not within the A or X range for the initial core will be considered for adjustment.

Pavement units represented by three cores, the initial core which falls in the B thickness range will be paid for at an adjusted price as specified in Table 602-2. In determining the average thickness, measurements of individual cores which exceed the specified pavement thickness by more than  $\frac{1}{4}$  of an inch will be considered as the specified thickness plus  $\frac{1}{4}$  of an inch.

Pavement units represented by three cores, the initial core which falls in the Y reinforcement depth range, will be defined by either Table 602-3A or 602-3B. Apply the table that results in the greatest contract price decrease.

Calculate the average reinforcement depth for pavement units represented by three cores. Use the average reinforcement depth and Table 602-3A to determine the contract price decrease.

For pavement units, represented by three cores, where the location of reinforcement is on both the high and low sides of the X (design) range, calculate the absolute deviation from the limits of the X range for each core. Calculate the average deviation for the pavement unit and use Table 602-3B to determine the contract price decrease.

If cores indicate that reinforcement is outside the X range tolerance, then the absolute deviation shall be calculated from the limits of the X range. Use the average deviation and Table 602-3B to determine the price adjustment, in lieu of Table 602-3A.

Pavement units represented by three cores, in which both pavement thickness and depth of reinforcement are considered and which fall in the B and Y ranges, will be paid for at an adjusted price based on the percentages specified in Tables 602-2 and either 602-3A or 602-3B. The total pay adjustment for the unit will be calculated using the summation of the pay adjustments involved.

Initial cores in a C and/or Z range represent an area of 10 feet (5 feet on either side of the core) by the width of the pavement unit. Such areas will be deducted from the

remainder of the pavement unit. The remainder of the pavement unit will be represented by a new initial core and the above procedure will apply. The Contractor shall remove and replace C and Z range areas as specified by the Engineer. Any area of pavement removed shall not be less than 10 feet in length. If within 15 feet of a transverse joint, the area or section shall be removed to the joint. The areas replaced with concrete pavement meeting the specified requirements will be paid for at the contract unit price.

**Table 602-2 Classification of Cores and Price Adjustment for Concrete Pavement, Shoulder, and Base Course Deficient in Thickness**

Core Type	Deficiency in Thickness Determined by Cores, inches	Contract Price Decrease, Percent
A	0.2 or less	0
B	0.3	5
B	0.4	15
B	0.5	25
B	0.6 to 1.0 inclusive	50
C	1.1 and over	100 (a)
a. Remove and replace pavement.		

**Table 602-3A Classification of Cores and Price Adjustment of Reinforced Concrete Pavement, Shoulder, and Base Course where Reinforcement is Out of Tolerance On One Side of the Design Range**

Core Type	Depth Range of Reinforcement, inches (a) (e)					Contract Price Decrease, %
	For Uniform Plan Thicknesses, inches (c)					
	7 ¾ to 8½	8 ¾ to 9 ½	9 ¾ to 10 ½	10 ¾ to 11½	Shoulder	
Z	0.0 -0.9	0.0-0.9	0.0-0.9	0.0-0.9	0.0-0.9	100 (d)
Y	1.0 - 1.9	1.0-1.9	1.0-1.9	1.0-2.4	1.0-2.4	25 (d)
X (b)	2.0 - 4.0	2.0-4.5	2.0-5.0	2.5-5.5	2.0-4.0	0
Y (b)	4.1-4.8	4.6-5.4	5.1-6.0	5.6-6.6	4.1-5.0	25
Y (b)	4.9-6.4	5.5-7.2	6.1-8.0	6.7-8.8	5.1 & over	50
Z (b)	6.5 and over	7.3 and over	8.1 and over	8.9 and over	-----	100 (d)
a When a pavement is specified to be reinforced with two layers of reinforcement, only the top layer of steel will be measured for proper depth.						
b. When a core length measures 0.2 inches or more over the plan thickness, the maximum depth range will be increased by one-half of the excess core length over the plan thickness. For each core, the increase will be rounded off to the nearest tenth of an inch according to AASHTO R 11 and then added to the range shown.						
c. Pavement or Base Course.						
d. Remove and replace pavement.						
e. Use same depth range used for pavement thickness that the shoulder is tied to. Use average shoulder thickness, if tapered.						

**Table 602-3B Classification of Cores and Price Adjustment of Reinforced Concrete Pavement, Shoulder, and Base Course where Reinforcement is Out of Tolerance on Both Sides of the Design Range**

Core Type	Deviation from Design Depth of Reinforcement (a) (b)					Contract Price Decrease, %
	For Uniform Plan Thickness, inches (c)					
	6.5 to 7.5	7.75 to 8.5	8.75 to 9.5	9.75 to 10.5	11 to 13	
X(d)	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0.0-0.5	0
Y(d)	0.5-1.0	0.5-1.0	0.5-1.0	0.5-1.0	0.5-1.0	10
Y(d)	1.0 and over	1.0 and over	1.0 and over	1.0 and over	1.0 and over	25
Design Range	2.0-4.0	2.0-4.0	2.0-4.5	2.5-5.5	2.5-6.0	
a. When a pavement is specified to be reinforced with two layers of reinforcement, only the top layer of steel will be measured for proper depth.						
b. Use same depth range used for pavement thickness that the shoulder is tied to. Use average shoulder thickness, if tapered.						
c. Pavement or Base Course.						
d. When a core length measures 0.2 inches or more over the plan thickness, the maximum depth range will be increased by one-half of the excess core length over the plan thickness. For each core, the increase will be rounded off to the nearest tenth of an inch according to AASHTO R11 and then added to the range shown.						